FIBER OPTIC SENSORS

DF-G1

D10

D12

R55F

DF-G1 page 234

- Simple user interface ensures easy sensor set-up and programming
- Expert TEACH and SET for low contrast applications
- Thermally stable electronics minimize warm-up drift and the effect of side-by-side mounting of multiple fiber amplifiers

D10 page 240

- Advanced amplifier for use with plastic fibers
- High-performance, low-contrast sensor with numeric or bargraph display
- Models with push-button programming or manual gain adjustment
- Bussable power models for simplified wiring

D12 page 249

- Glass and plastic fiber optic models
- Models for standard applications, high-speed response and increased power
- AC-coupled for high-sensitivity applications

R55F page 254

- Green, blue, white, red or infrared LED colors
- For mounting flat or to a 35 mm DIN rail
- Models for glass and plastic fiber optics

Plastic Fibers page 258

- Inexpensive and easily cut to length during installation
- Very bendable, for a precise fit
- Available coiled, for applications requiring articulated or reciprocating motion
- Diameters of 0.25, 0.5, 1.0 or 1.5 mm

Glass Fibers page 276

- For hostile environments: high temperatures, corrosive materials, extreme moisture and high levels of shock and vibration
- Inherent immunity to extreme electrical noise
- Quickly custom designed and built for your unique applications

The broadest selection of fiber systems in the world.

Fiber Systems

Two-part fiber systems include the sensor and the separately purchased application-specific fiber.

1. Sensors

The sensor contains all the electronics, the amplifier and the mechanical interface to the fiber. Some models are sealed and rated IP67 to mount directly on a machine; others are designed to be DIN-rail mounted in a centralized control enclosure.

2. Fibers

Sensing fibers are non-electronic, light-transmitting, optical-quality glass or plastic strands encased in cladding that reflects light to the core. Fibers transmit and/or receive light from the LED of a sensor. Glass fibers are arranged in bundles, and plastic fibers are typically packaged as monofilaments with a protective jacket of polyethylene, PVC, stainless-steel braid or other material. Fiber sensing tips have a wide variety of shapes and configurations.

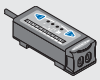
When to Use Fiber Systems

- **Confined areas.** The small size and flexibility of fibers allows precise positioning where space is limited.
- **High temperatures.** Fiber optic assemblies can tolerate elevated temperatures—in some cases as high as 480° C.
- **High vibration and shock.** The low mass of fibers enables them to withstand extreme vibration and mechanical shock.
- **Corrosive and wet environments.** Special-purpose fibers withstand corrosive materials, moisture and even repeated washdown.
- **Explosive environments.** Fibers are passive and can safely pipe light to and from hazardous areas.
- **Noisy environments.** Fibers are non-electronic mechanical components and are completely immune to electrical noise.
- **Unique target shapes and requirements.** Fiber optic sensing heads can be custom designed and optimally shaped to the physical and optical requirements of a specific application.

Typical Applications

- Punch presses
- Vibratory feeders
- Conveyors
- Web control
- Tablet counting
- Ovens
- Semiconductor processing equipment
- Liquid level

DIN Rail Mountable Amplifiers for use with Fibers

Sensor Model	Models for Plastic Fibers	Models for Glass Fibers	Page Number
DF-G1			page 234
D10			page 240
D12			page 249
R55F			page 254
D11			page 373

Sealed Machine Mountable Sensors for use with Fibers

Sensor Model	Models for Plastic Fibers	Models for Glass Fibers	Page Number
WORLD-BEAM® QS18			page 92
MINI-BEAM®			page 118
QM42			page 193
Q45			page 200
OMNI-BEAM™			page 217
FI22			page 373
ECONO-BEAM®			page 373
MAXI-BEAM®			page 373
MULTI-BEAM®			page 373
PC44			See datasheet
VALU-BEAM®			page 373

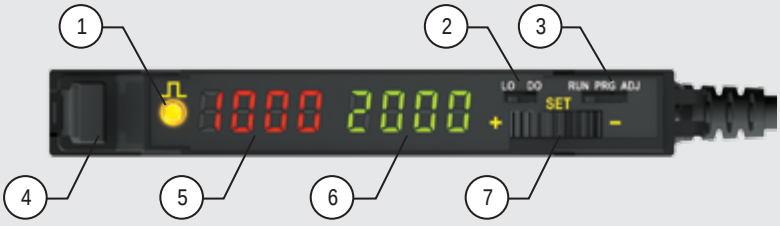
SENSORS

Expert Dual Display Fiber Amplifier
DF-G1 Series

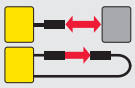
- Easy-to-read dual digital displays show both signal level and threshold simultaneously
- Lever action fiber clamp provides stable, reliable and trouble-free fiber clamping
- Simple user interface ensures easy sensor set-up and programming via displays and switches/buttons, remote input teach wire or IO-Link
- Expert TEACH and SET methods ensure optimal gain and threshold for all applications, especially low contrast applications
- User has full control over all operating parameters: threshold, Light or Dark Operate, output timing functions, gain level, and response speed
- Thermally stable electronics minimize warm-up drift and the effect of side-by-side mounting of multiple fiber amplifiers
- ECO (economy) display mode reduces amplifier power consumption by 25%
- Cross talk avoidance algorithm allows two sensors to operate in close proximity for many applications
- Response speeds of: 200 µs (High Speed), 500 µs (Standard Speed), 2 ms (Long Range), and 5 ms (Extra Long Range) allow operator to optimize for fast or long distance applications
- Sleek 10 mm wide housing mounts to standard 35 mm DIN rail
- Visible red LED sensing beam for easy alignment to the target

ACCESSORIES PAGE 239
PLASTIC FIBERS PAGE 258
PLASTIC FIBER
GLASS FIBER

1	Output LED
2	LO/DO Switch
3	RUN/PRG/ADJ Mode Switch
4	Lever Action Fiber Clamp
5	Red Signal Level
6	Green Threshold
7	+/Set/- Rocker Button



DF-G1, 10-30V dc

Sensing Mode/LED	Connection	Range	Output	Model
 PLASTIC FIBER	2 m	Range varies by Speed Selection used and with fiber optics used. See fibers section on page 259 or reference website for range information.	NPN	DF-G1-NS-2M
			PNP	DF-G1-PS-2M
	Integral M8 Pico connector		NPN	DF-G1-NS-Q7
			PNP	DF-G1-PS-Q7
	150mm PVC pigtail, M12 Euro connector		IO-Link	DF-G1-KS-Q5

Connection options: A model with a QD requires a mating cordset (see page 239).

For 9 m cable, change the suffix 2M to 9M in the 2 m model number (example, DF-G1-NS-9M).

For M8 Pico pigtail change the suffix 2M to Q3 in the 2 m model number (example, DF-G1-NS-Q3).
For M12 Euro pigtail change the suffix 2M to Q5 in the 2 m model number (example, DF-G1-NS-Q5).

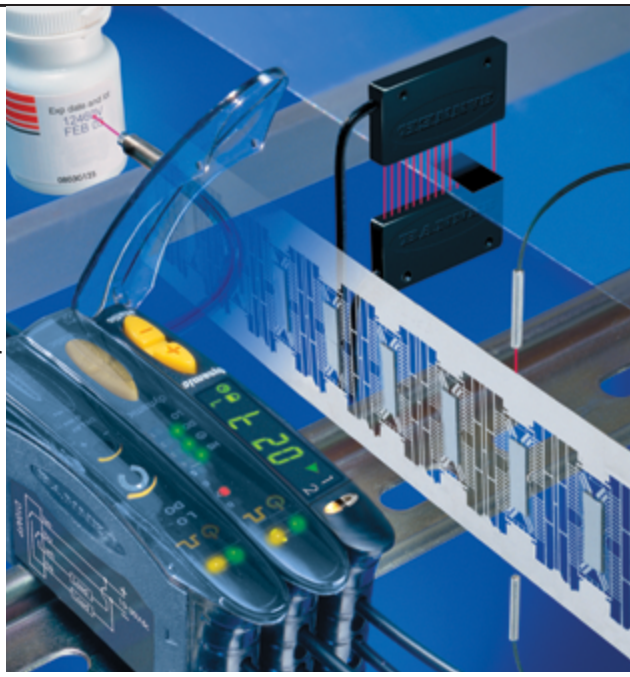
DF-G1 Specifications

Supply Voltage and Current	10 to 30V dc (10% max ripple) @ less than 100 mA exclusive of load Standard Mode: 960 mW, Current consumption < 40 mA @ 24V dc ECO Mode: 720 mW, Current consumption < 30 mA @ 24V dc
Supply Protection Circuitry	Protected against reverse polarity, over voltage, and transient voltages
Output Configuration	1 current sourcing (PNP) or 1 current sinking (NPN) output, depending on model
Output Rating	100 mA max. load (derate 1 mA per °C above 30° C) OFF-state leakage current: < 5 µA at 30V dc ON-state saturation voltage: NPN: < 1.5V; PNP: < 2V
Output Protection Circuitry	Protected against output short-circuit, continuous overload, transient over-voltages, and false pulse on power up
Output Response Time	High Speed: 200 us Standard: 500 us Long Range: 2 ms Extra Long Range: 5 ms
Delay at Power-up	500 milliseconds max.; outputs do not conduct during this time
Adjustments	3-way RUN/PRG/ADJ Mode Switch 2-way LO/DO Switch 3-way +/SET/- Rocker Button See datasheet for detailed information.
Indicators	Red 4-digit Display: Signal Level Green 4-digit Display: Threshold (In Program Mode, Red and Green displays are used for programming menus) Yellow LED: Output conducting
Construction	Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover
Environmental Rating	IEC IP50, NEMA 1
Connections	PVC-jacketed 2 or 9 m 4-wire integral cable, integral 4-pin Pico-style QD, Pico-style QD or Euro QD. See page 239.
Operating Conditions	Temperature: -10° to +55° C Storage: -20° to +85° C Relative Humidity: 95% @ 60° C (non-condensing)
Certifications	CE
Hookup Diagrams	DC07 (p. 789)

SENSORS

High-Performance Fiber Optic Sensing

D10 Series



- Features advanced fiber optic amplifier for use with plastic fibers
- Available in bipolar, discrete and analog/discrete output models
- Available with a numeric or bargraph display on Expert™ models
- Delivers high-performance, low-contrast sensing with automatic TEACH options or manual adjustment
- Available with visible red or green beam
- Available in Light or Dark Operate
- Includes specially designed models for reliable detection of objects as small as 1.5 mm
- Features bussable models for side-by-side mounting and simplified wiring of up to 16 sensors
- Features thin 10 mm housing for standard 35 mm DIN-rail mounting

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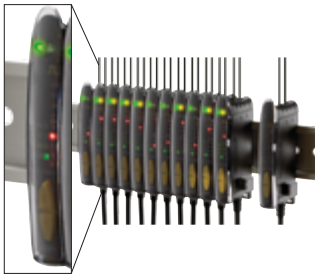
PLASTIC FIBERS PAGE 258
PLASTIC FIBER

D10 *Expert*™ with Numeric Display

page 241

- Numeric display of signal strength and operating status
- Two output options: two discrete outputs in the same sensor; or discrete output and either a 4-20 mA current or a 0-10V dc voltage analog output in the same sensor
- Push buttons for easy-to-set static, dynamic light set, dark set and window set programming
- Manual fine tuning and remote configuration using TEACH wire
- Four mode power and speed selection with automatic crosstalk avoidance circuity
- Response times as fast as 50 microseconds



D10 *Expert*™ with Bargraph Display

page 242

- Easy-to-read 8-segment light bar display indicator for TEACH and signal strength
- Bipolar discrete outputs: one current sourcing (PNP) and one current sinking (NPN)
- Push buttons for easy-to-set static, dynamic light set, dark set and window set programming
- Manual fine tuning
- Bussable power models with improved temperature compensation for side-by-side mounting and simplified wiring of up to 16 sensors
- Selectable high-speed mode option for 200 microsecond response

D10—Discrete Output

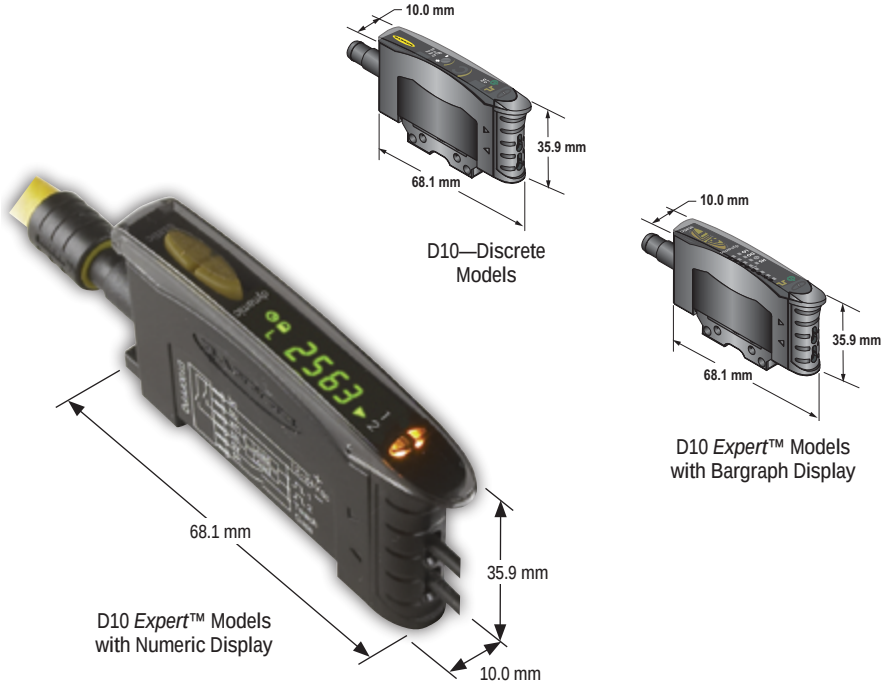
page 242

- 12-turn manual sensitivity adjustment
- Pulse rate LED indicator for signal strength
- Bipolar discrete outputs: one current sourcing (PNP) and one current sinking (NPN)
- Response time as fast as 200 microseconds

D10 *Expert*™ Small Object Counter

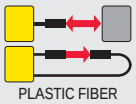
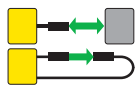
page 243

- Reliable low-contrast sensing for small object counting
- Easy-to-set selectable threshold with automatic compensation algorithm to compensate for dust or contamination on the fiber optic array and for ambient temperature changes
- Single discrete output plus Health mode output to indicate preventative maintenance is required
- A choice of three standard size fiber optic assemblies
- Custom size fibers for your application
- User-configurable Dynamic Event Stretcher (DES) to prevent double counting of objects
- Push buttons or remote wire for easy sensor configuration



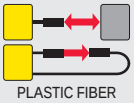
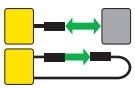
D10 *Expert*™ with Numeric Display—Dual Discrete, 12-24V dc

Visible Red LED Visible Green LED

Sensing Mode/LED	Range	Connection	Models Dual NPN	Models Dual PNP
 PLASTIC FIBER	Range varies by Power Level/Speed Selection used and with fiber optics used. See datasheet for range information.	2 m	D10DNFP	D10DPFP
		6-pin Snap-on Pico QD	D10DNFPQ	D10DPFPQ
 PLASTIC FIBER		2 m	D10DNFPG	D10DPFPG
		6-pin Snap-on Pico QD	D10DNFPGQ	D10DPFPGQ

D10 *Expert*™ with Numeric Display—Analog/Discrete, 12-24V dc

Visible Red LED Visible Green LED

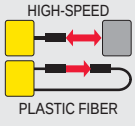
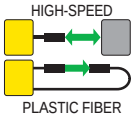
Sensing Mode/LED	Range	Connection	Analog Output	Models NPN	Models PNP
 PLASTIC FIBER	Range varies by Power Level/Speed Selection used and with fiber optics used. See datasheet for range information.	2 m	4-20 mA	D10INFP	D10IPFP
		6-pin Snap-on Pico QD		D10INFPQ	D10IPFPQ
 PLASTIC FIBER		2 m	4-20 mA	D10INFPG	D10IPFPG
		6-pin Snap-on Pico QD		D10INFPGQ	D10IPFPGQ

Connection options: A model with a QD requires a mating cordset (see page 247).

For 9 m cable, add suffix W/30 to the 2 m model number (example, D10DNFP W/30).

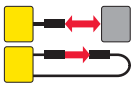
D10—Discrete, 10-30V dc (cont'd)

Visible Red LED Visible Green LED

Sensing Mode/LED	Range	Connection	Output Type	Response Time	Models
 HIGH-SPEED PLASTIC FIBER	Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 258 or reference datasheet range information.	2 m	Bipolar NPN/PNP	200 microseconds	D10AFPY
		4-pin Snap-on Pico QD			D10AFPYQ
 HIGH-SPEED PLASTIC FIBER		2 m			D10AFPGY
		4-pin Snap-on Pico QD			D10AFPGYQ

D10 *Expert*™ Small Object Counter with Numeric Display—Discrete, 12-24V dc

Visible Red LED

Sensing Mode/LED	Connection	Output	Sensor Models
 PLASTIC FIBER	2 m	NPN	D10DNCFP
	6-pin Snap-on Pico QD		D10DNCFPQ
	2 m	PNP	D10DPCFP
	6-pin Snap-on Pico QD		D10DPCFPQ

Fiber Optic Arrays

Detection Window Dimensions**	Fiber Exit	Minimum Object Detection†	Array Models*
10 x 25 mm	Side Exit	1.5 mm	PFCVA-10X25-S
	End Exit		PFCVA-10X25-E
25 x 25 mm	Side Exit	3 mm	PFCVA-25X25-S
	End Exit		PFCVA-25X25-E
34 x 25 mm	Side Exit	4 mm	PFCVA-34X25-S
	End Exit		PFCVA-34X25-E

Connection options: A model with a QD requires a mating cordset (see page 247).

For 9 m cable, add suffix W/30 to the 2 m model number (example, D10DNDFP W/30).

* Custom fiber arrays and mounting configurations are possible. Consult factory for assistance with your small object counting application.
** Detailed dimension drawings for fibers are on page 247.
† With 2% Threshold Offset Percentage

D10 *Expert*™ with Numeric Display—Dual-Discrete Specifications

Required Fiber Optic Cable	Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 258)
Supply Voltage and Current	12 to 24V dc (10% max. ripple) at less than 65 mA, exclusive of load
Supply Protection Circuitry	Protected against reverse polarity and transient voltage
Output Configuration	Two independently configured current sourcing (PNP) or current sinking (NPN) solid-state transistors, depending on model
Output Rating	150 mA max. load OFF-state leakage current: less than 10 µA at 24V dc ON-state saturation voltage: NPN: less than 1.5V at 150 mA load PNP: less than 2.5V at 150 mA load
Output Protection Circuitry	Protected against false pulse on power-up and continuous short-circuit

More on next page

ACCESSORIES PAGE 247

D10 *Expert*™ with Numeric Display—Dual-Discrete Specifications (cont'd)

Output Response Time	Programmable, 50 microseconds, 200 microseconds, 1 millisecond, 2.5 milliseconds
Delay at Power-up	Less than 1 second; outputs do not conduct during this time
Adjustments	Two push buttons or remote programming of (TEACH) switching threshold response time, OFF-delay, Light/Dark Operate, and display
Indicators	Four-digit digital display plus LED indicators for active channel, push-button lockout, OFF-delay and Light/Dark Operate selection; two yellow LED output indicators
Construction	Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover
Environmental Rating	IEC IP50; NEMA 1
Connections	PVC-jacketed 2 m or 9 m 6-wire integral cable, or integral 6-pin Pico-style quick-disconnect fitting. QD cordsets are ordered separately. See page page 247.
Operating Conditions	Temperature: -20° to +55° C Storage Temperature: -20° to +80° C Relative humidity: 90% @ 50° C

Number of Devices Stacked	Ambient Temperature Rating	Load Specification
3	55° C	150 mA
7	50° C	50 mA
10	45° C	50 mA

Installation	35 mm DIN rail or included mounting bracket
Certifications	CE cULus
Hookup Diagrams	DC15 (p. 791)

D10 *Expert*™ with Numeric Display—Analog/Discrete Specifications

Required Fiber Optic Cable	Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 258)
Supply Voltage and Current	4-20 mA Analog Models: 12-24V dc (10% max. ripple) at less than 65 mA exclusive of load 0-10V dc Analog Models: 15-24V dc (10% max. ripple) at less than 70 mA exclusive of load
Supply Protection Circuitry	Protected against reverse polarity and transient voltage
Output Configuration	Two independently configurable outputs, depending on model: NPN w/analog (4-20 mA or 0-10V) or PNP w/analog (4-20 mA or 0-10V)
Output Rating	Discrete Output: 150 mA, max. load OFF-state leakage current: less than 10 µA at 24V dc ON-state saturation voltage: NPN: < 1.5V @ 150 mA PNP: < 2.5V @ 150 mA Analog Output: 4-20 mA or 0-10V dc Load: 4-20 mA Models: 100Ω max. impedance 0-10V dc Models: 1 MΩ min. impedance
Output Protection Circuitry	Protected against false pulse on power-up and continuous short-circuit
Output Response Time	Discrete Output: Programmable, 50 microseconds, 200 microseconds, 1 millisecond, 2.5 milliseconds Analog Output: 1 millisecond
Delay at Power-up	Less than 1 second; outputs do not conduct during this time
Adjustments	Push-button or remote programming of (TEACH) switching threshold response time, OFF-delay, Light/Dark Operate, and display
Indicators	Four-digit digital display plus LED indicators for active channel, push-button lockout, OFF-delay and Light/Dark Operate selection; two yellow output indicators
Construction	Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover
Environmental Rating	IEC IP50; NEMA 1
Connections	PVC-jacketed 2 m or 9 m 6-wire integral cable, or integral 6-pin Pico-style quick-disconnect. QD cordsets are ordered separately. See page 247.
Operating Conditions	Temperature: -20° to +55° C Storage Temperature: -20° to +80° C Relative humidity: 90% @ 50° C

Number of Devices Stacked	Ambient Temperature Rating	Load Specification
3	55° C	150 mA
7	50° C	50 mA
10	45° C	50 mA

Installation	35 mm DIN rail or included mounting bracket
Certifications	CE cULus
Hookup Diagrams	NPN Models: DC16 (p. 791) PNP Models: DC17 (p. 792)

D10 *Expert*™ with Bargraph Display—Discrete Specifications

	Standard Sensors	Models with Bussable Power
Required Fiber Optic Cable	Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 258)	
Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than 45 mA, exclusive of load	12 to 30V dc (10% max. ripple) at less than 45 mA, exclusive of load
Supply Protection Circuitry	Protected against reverse polarity, over voltage and transient voltage	
Delay at Power Up	200 milliseconds max.; outputs do not conduct during this time	850 milliseconds max.; outputs do not conduct during this time
Output Configuration	Bipolar: 1 current sourcing (PNP) and 1 current sinking (NPN)	Main units: Bipolar; 1 current sourcing (PNP) and 1 current sinking (NPN) Sub-units: 1 current sourcing (PNP) or 1 current sinking (NPN) output, depending on model
Output Rating	150 mA max. load @ 25° C (derate 1 mA per ° C increase) OFF-state leakage current: less than 5 µA at 30V dc ON-state saturation voltage: NPN: less than 200 mV at 10 mA and 1V at 150 mA load PNP: less than 1V at 10 mA and 1.5V at 150 mA load	100 mA max. load (derate 1 mA per ° C) OFF-state leakage current: less than 5 µA at 30V dc ON-state saturation voltage: NPN: less than 1.5V PNP: less than 2V Less than 15V supply (9 m cable): up to 4 units with 100 mA outputs up to 8 units with 50 mA outputs
Output Protection Circuitry	Protected against output short-circuit, continuous overload, transient over-voltages, and false pulse on power-up	
Output Response Time	500 microseconds (normal mode) or 200 microseconds (high-speed mode)	
Repeatability	100 microseconds (normal mode) or 66 microseconds (high-speed mode)	
Adjustments	Two push buttons and remote wire • *Expert* -style configuration (Static and Dynamic TEACH, light SET, dark SET and Windows SET) • Manually Adjust (+/–) sensitivity (from buttons only) • LO/DO, OFF-Delay, and response speed configurable (from buttons or remote wire) • Push-button lockout (from remote wire only) Factory Default Settings: Light Operate, Normal Speed, No Delay	
Indicators	8-segment red bargraph* Green Status Indicators: LO, DO, High Speed (HS) and OFF-Delay Green LED: Power ON Yellow LED: Output conducting *See datasheet for detailed information	
Construction	Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover	
Environmental Rating	IEC IP50, NEMA 1	
Connections	PVC-jacketed 2 m or 9 m 6-wire integral cable, or integral 6-pin Pico-style quick-disconnect. QD cordsets are ordered separately. See page 247.	Main units: PVC-jacketed 2 m or 9 m 5-wire integral cable Sub-units: PVC-jacketed 2 m or 9 m 2-wire integral cable
Operating Conditions	Temperature: -10° to +55° C Storage Temperature: -20° to +85° C Relative humidity: 90% @ 55° C	
Installation	35 mm DIN rail or included mounting bracket	
Certifications	CE cULus	
Hookup Diagrams	Standard Models and Main Unit: DC08 (p. 789) Sub-Units: DC09 (p. 790)	

D10—Discrete Specifications

Required Fiber Optic Cable	Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 258)
Supply Voltage & Current	10 to 30V dc (10% max. ripple) @ less than 25 mA, exclusive of load
Supply Protection Circuitry	Protected against reverse polarity and transient voltage
Output Configuration	Bipolar: 1 current sourcing (PNP) and 1 current sinking (NPN)
Output Rating	100 mA per output with short circuit protection OFF-state leakage current: less than 10 µA sourcing; 200 µA sinking ON-state saturation voltage: NPN: 1.6V @ 100 mA PNP: 2.0V @ 100 mA
Output Protection Circuitry	Protected against output short-circuit and false pulse on power up
Delay at Power-up	Max. 100 milliseconds; outputs do not conduct during this time

More on next page

D10—Discrete Specifications (cont'd)

Output Response Time	Standard models (with crosstalk avoidance circuitry): 500 microseconds High-speed models: 200 microseconds
Repeatability	Standard models: 95 microseconds High-speed models: 50 microseconds
Adjustments	12-turn Sensitivity potentiometer with relative position indicator; LO/DO Selection switch; 0 or 40 milliseconds OFF-delay switch NOTE: Use proper ESD techniques while making adjustments under cover
Indicators	Two LEDs: Green and Yellow Green: Power ON Yellow: Light Sensed Signal strength indicator See datasheet for detailed information
Construction	Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover
Environmental Rating	IEC IP50; NEMA 1
Connections	PVC-jacketed 2 m or 9 m attached cable, or 4-pin Pico-style quick-disconnect fitting. QD cordsets are ordered separately. See page 247.
Operating Conditions	Temperature: -10° to +55° C Storage: -20° to +85° C Relative humidity: 90% @ 55° C (non-condensing)
Certifications	CE c UL us
Hookup Diagrams	DC04 (p. 788)

D10 *Expert*™ Small Object Counter—Numeric Display Specifications

Required Fiber Optics	PFCVA models (Custom fiber arrays and mounting configurations are possible. Consult factory for assistance with your small object counting application.)
Sensing Beam	Visible red, 680 nm
Supply Voltage and Current	12 to 24V dc (10% maximum ripple) at less than 65 mA, exclusive of load
Supply Protection Circuitry	Protected against reverse polarity and transient voltage
Output Configuration	2 NPN or 2 PNP, depending on model
Output Rating	150 mA maximum load OFF-state leakage current: < 10 µA at 24V dc ON-state saturation voltage: NPN < 1.5V at 150 mA load PNP < 2.5V at 150 mA load
Output Protection Circuitry	Protected against false pulse on power-up and continuous short-circuit
Output Response Time	Programmable, 150 microseconds, 225 microseconds, 300 microseconds
Delay at Power-up	Less than 1 second; outputs do not conduct during this time
Adjustments	Push-button or remote programming of threshold offset percentage, Light/Dark Operate, Dynamic Event Stretcher (DES), display, and power/speed
Indicators	Four-digit digital display, 2 arrow icons, push-button lockout, Dynamic Event Stretcher, Light/Dark Operate selection and 2 amber output LEDs
Construction	Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover
Environmental Rating	NEMA 1; IEC IP50
Connections	PVC-jacketed 2 m or 9 m 6-wire integral cable or integral 6-pin Pico-style quick-disconnect. QD cordsets are ordered separately. See page 247.
Operating Conditions	Temperature: -20° to +55° C Storage Temperature: -20° to +80° C Relative Humidity: 90% @ 50° C (non-condensing)
Installation	35 mm DIN rail or included mounting bracket
Certifications	CE
Hookup Diagrams	DC18 (p. 792)

Number of Devices, Stacked	Ambient Temperature Rating	Load Specification
3	55° C	150 mA
7	50° C	50 mA
10	45° C	50 mA

Complete Family of Plastic and Glass Fiber Optic Sensors

D12

- Features LED bargraph that indicates signal strength, sensing contrast, programming status and diagnostic warnings, when not in high-speed mode
- Available in glass and plastic fiber optic models
- Includes marginal gain indicator with alarm output
- Solves routine applications with economical standard models
- Features high-speed sensing response and higher sensing power in some models
- Excels in low-contrast applications with ac-coupled models
- Features easy push-button TEACH-mode setup on D12E Expert™ models
- Easily mounts to standard 35 mm DIN-rail mounting

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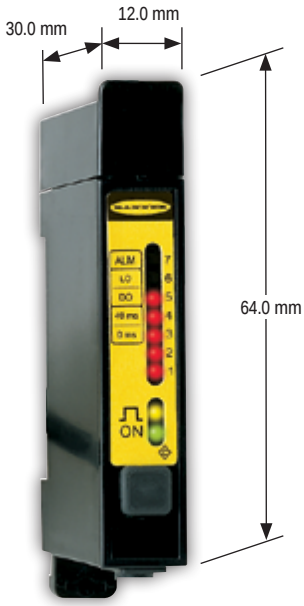
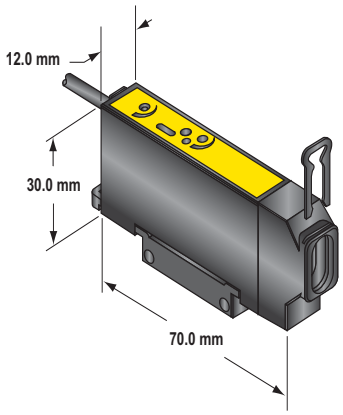
PLASTIC FIBERS PAGE 258
GLASS FIBERS PAGE 276
PLASTIC FIBER
GLASS FIBER



Plastic Fiber Models
Suffix FP and FPY



Glass Fiber Models
Suffix FV and FVY

D12 *Expert*™, 10-30V dc

Visible Red LED

Sensing Mode/LED	Maximum Range	Switching Threshold Setting	Connection	Models NPN	Models PNP
GLASS FIBER	Range varies by sensing mode and fiber optics used. See datasheet for maximum range specifications.	Just above the “dark” condition	2 m	D12EN6FV	D12EP6FV
		Midway between “dark” and “light” conditions		D12E2N6FV	D12E2P6FV
PLASTIC FIBER		Just above the “dark” condition		D12EN6FP	D12EP6FP
		Midway between “dark” and “light” conditions		D12E2N6FP	D12E2P6FP

Connection options: A model with a QD requires a mating cordset (see page 253).

For 9 m cable, add suffix W/30 to the 2 m model number (example, D12EN6FV W/30).

D12 *Expert*™ Specifications

Supply Voltage and Current	10 to 30V dc at 45 mA max. (exclusive of load); 10% max. ripple
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	NPN open collector (both outputs) or PNP open collector (both outputs), depending on model Load output: Normally open and programmable Light or Dark Operate; Alarm output: Normally open
Output Rating	150 mA max. each output OFF-state leakage current: less than 10 µA at 30V dc ON-state saturation voltage: less than 1 volt at 10 mA dc; less than 1.5 volts at 150 mA dc The total load may not exceed 150 mA
Output Protection Circuitry	Protected against false pulse on power-up and short circuit of outputs (trips at 175 mA)
Output Response Time	200 microseconds ON/OFF (40 milliseconds OFF when OFF-delay selected) NOTE: False pulse protection circuit causes a 0.1 second delay on power-up
Output Operation Mode	Light or Dark Operate: selected by push button
Output Timing Functions	ON/OFF (no delay) or fixed 40 millisecond OFF-delay; selected by push button
Repeatability	66 microseconds
Adjustments	Push-button TEACH-mode sensitivity setting; Remote teaching input is provided
Indicators	Green: power ON and flashes when ready for TEACH mode Yellow: output conducting 7-segment moving dot red LED See datasheet for detailed information
Mounting Bracket	D12 Sensors mount directly to a standard DIN rail, or may be through-hole mounted using the supplied mounting bracket and M3 x 0.5 hardware
Construction	Black ABS housing with acrylic cover, stainless steel M3 x 0.5 hardware for use with thermoplastic polyester mounting bracket (supplied); the plastic fiber clamping element is acetal
Environmental Rating	IEC IP11; NEMA 2
Connections	PVC-jacketed 2 m or 9 m cables, or 150 mm pigtail with 4-pin Pico-style quick-disconnect (QD) are available. QD cordsets are ordered separately. See page 253.
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Certifications (except D10E2)	CE c UL us
Hookup Diagrams	DC19 (p. 792)

D12 Standard, High-Speed and High-Power Specifications

Supply Voltage and Current	10 to 30V dc at 45 mA max. (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Outputs are NPN (sinking) or PNP (sourcing), depending on model Complementary: one normally open (NO) and the other normally closed (NC); NC output may be wired as diagnostic alarm output by reversing power supply connections except high speed "Y" and "Y1" suffix models (see hookups)
Output Rating	150 mA max. each output OFF-state leakage current: less than 10 µA at 30V dc ON-state saturation voltage: less than 1 volt at 10 mA dc; less than 1.5 volts at 150 mA dc The total load may not exceed 150 mA
Output Protection Circuitry	Protected against false pulse on power-up and short circuit of outputs
Output Response Time	Standard and High-Power Models: 500 microseconds ON/OFF High-Speed Models: selectable 50 or 500 microseconds ON/OFF NOTE: False pulse protection circuit causes a 0.1 second delay on power-up
Output Timing Functions	"Y1" models have fixed 20 milliseconds pulse stretcher (OFF-delay) when 50 microseconds mode is used
Repeatability	130 microseconds; "Y" and "Y1" models have selectable 50 microseconds/500 microseconds response; repeatability in 50 microseconds mode is 15 microseconds
Adjustments	15-turn adjustment sensitivity; "Y" and "Y1" (high-speed models) also have a response mode selector switch

More on next page

D12 Standard, High-Speed and High-Power Specifications (cont'd)

Indicators	Two top-mounted LED indicators: one yellow and one green, and one 7-segment red LED moving dot bargraph; Note that the 7-segment bargraph and marginal excess gain indication (bargraph segment #7) are inoperative in the 50 µs response mode of "Y" and "Y1" models Green: LED lights for DC Power ON Yellow: LED lights for normally open output conducting On all models in 500 microseconds response mode, the 7-segment moving dot red LED bargraph lights to indicate relative received light signal strength; On all models in 50 and 500 microseconds response mode, segment #1 flashes to indicate OUTPUT OVERLOAD; On all models in the 500 microseconds response mode, segment #7 flashes to indicate MARGINAL EXCESS GAIN; On standard and high-power models, a flashing LED corresponds to the "ON" state of the alarm output; (Alarm output not available on Y & Y1 models)
Mounting Bracket	D12 Sensors mount directly to a standard DIN rail, or may be through-hole mounted using the supplied mounting bracket and M3 x 0.5 hardware
Construction	Black ABS housing with acrylic cover, stainless steel M3 x 0.5 hardware for use with thermoplastic polyester mounting bracket (supplied); the plastic fiber clamping element is acetal
Environmental Rating	IEC IP11; NEMA 2
Connections	PVC-jacketed 2 m or 9 m cables, or 150 mm pigtail with 4-pin Pico-style quick-disconnect (QD) are available. QD cordsets are ordered separately. See page 253.
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Certifications	
Hookup Diagrams	NPN Models: DC05 (p. 789) PNP Models: DC06 (p. 789)

D12 AC-Coupled Specifications

Supply Voltage and Current	10 to 30V dc at 60 mA max. (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Bipolar: one NPN (current sinking) and one PNP (current sourcing) open-collector transistor
Output Rating	150 mA max. each output OFF-state leakage current: less than 10 µA at 30V dc ON-state saturation voltage: less than 1 volt at 10 mA dc; less than 1.5 volts at 150 mA dc The total load may not exceed 150 mA
Output Protection Circuitry	Protected against false pulse on power-up and short circuit of outputs
Output Response Time	50 microseconds ON/OFF NOTE: False pulse protection circuit causes a 0.1 second delay on power-up
Output Operation Mode	Light Operate or Dark operate: selected by switch
Output Timing Functions	Pulse output; adjustable from 1 to 70 milliseconds
Repeatability	15 microseconds ON
Adjustments	Three top-panel controls: SENSITIVITY control (15-turn slotted brass screw, clutched at both ends of adjustment), a Light- or Dark-Operate select switch, and an OUTPUT PULSE adjustment (3/4-turn potentiometer)
Indicators	Three top-mounted LED indicators: Green LED: Lights to indicate dc Power ON Yellow LED: Lights for Output Conducting Red LED: Lights whenever AGC system is locked onto the signal
Mounting Bracket	D12 Sensors mount directly to a standard DIN rail, or may be through-hole mounted using the supplied mounting bracket and M3 x 0.5 hardware
Construction	Black ABS housing with acrylic cover, stainless steel M3 x 0.5 hardware for use with thermoplastic polyester mounting bracket (supplied); the plastic fiber clamping element is acetal
Environmental Rating	IEC IP11; NEMA 2
Connections	PVC-jacketed 2 m or 9 m cables, or 150 mm pigtail with 4-pin Pico-style quick-disconnect (QD) are available. QD cordsets are ordered separately. See page 253.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Application Note	D12 AC-coupled sensors should not be used in areas of known electrical "noise" or RF fields.
Certifications	
Hookup Diagrams	DC04 (p. 788)

SENSORS

Glass or Plastic Fiber Optic Sensors
R55F

- Delivers outstanding color contrast sensitivity
- Features innovative TEACH function with two options for setting the sensing threshold
- Reliably detects 16 levels of grayscale at up to 10,000 actuations per second
- Available in two fiber types: economical plastic for repeated flexing and glass for harsh conditions
- Easily mounts in confined areas, either flat or to 35 mm DIN rail
- Provides bipolar (NPN/PNP) outputs with delay settings of 0, 20 and 40 milliseconds
- Clearly displays relative received signal strength with 10-element indicator bargraph

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PLASTIC FIBERS PAG 258
GLASS FIBERS PAGE 276
PLASTIC FIBER
GLASS FIBER

R55F Fiber Optic, 10-30V dc

⇨ Infrared LED ➡ Visible Red LED

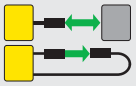
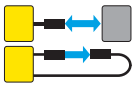
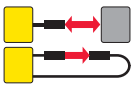
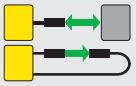
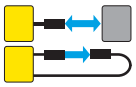
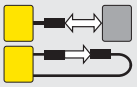
Sensing Mode/LED	Range	Connection	Output Type	Models
GLASS FIBER	Range varies by sensing mode and fiber optics used	2 m	Bipolar NPN/PNP	R55F
		5-pin Euro QD		R55FQ
GLASS FIBER		2 m		R55FV
		5-pin Euro QD		R55FVQ

Connection options: A model with a QD requires a mating cordset (see page 256).

For 9 m cable, add suffix W/30 to the 2 m model number (example, R55F W/30).

R55F Fiber Optic, 10-30V dc

Visible Green LED | Visible Blue LED | Visible White LED | Visible Red LED

Sensing Mode/LED	Range	Connection	Output Type	Models
 GLASS FIBER	Range varies by sensing mode and fiber optics used	2 m	Bipolar NPN/PNP	R55FVG
		5-pin Euro QD		R55FVGQ
 GLASS FIBER		2 m		R55FVB
		5-pin Euro QD		R55FVBQ
GLASS FIBER		2 m		R55FVW
		5-pin Euro QD		R55FVWQ
 PLASTIC FIBER		2 m		R55FP
		5-pin Euro QD		R55FPQ
 PLASTIC FIBER		2 m		R55FPG
		5-pin Euro QD		R55FPGQ
 PLASTIC FIBER		2 m		R55FPB
		5-pin Euro QD		R55FPBQ
 PLASTIC FIBER		2 m		R55FPW
		5-pin Euro QD		R55FPWQ

Connection options: A model with a QD requires a mating cordset (see page 256).

For 9 m cable, add suffix W/30 to the 2 m model number (example, R55F W/30).

R55F Fiber Optic Specifications

Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than 70 mA, exclusive of load
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Bipolar: One current sourcing (PNP) and one current sinking (NPN) open-collector transistor
Output Rating	150 mA max each output @ 25° C (derate ≈ 1 mA per ° C increase) OFF-state leakage current: less than 5 µA @ 30V dc ON-state saturation voltage: PNP: less than 1V @ 10 mA; 1.5V @ 150 mA NPN: less than 200 mV @ 10 mA; 1V @ 150 mA
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short-circuit of outputs
Output Response Time	50 microseconds
Delay at Power-up	100 milliseconds; outputs do not conduct during this time

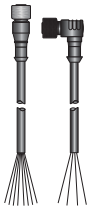
More on next page

R55F Fiber Optic Specifications (cont'd)

Adjustments	Using push buttons ("+" Dynamic and "-" Static): Manually adjust Switch Point using "+" or "-" buttons Dynamic TEACH (teach on-the-fly) sensitivity adjustment Static TEACH sensitivity adjustment Static Single-Point TEACH Light Operate/Dark Operate OFF-Delay select: 0 milliseconds, 20 milliseconds or 40 milliseconds Using Remote TEACH input (gray wire): Dynamic TEACH (teach on-the-fly) sensitivity adjustment Static TEACH sensitivity adjustment Static Single-Point TEACH Light Operate/Dark Operate OFF-Delay select: 0 milliseconds, 20 milliseconds or 40 milliseconds Push button lockout for security
Indicators	10-segment light bar indicates signal strength Light Operate: Green Dark Operate: Green Outputs Conducting: Yellow OFF-Delay (Green): SETUP Mode: OFF–no delay; Flashing–20 milliseconds delay; ON–40 milliseconds delay; RUN Mode: OFF–no delay; ON–20 or 40 milliseconds delay
Construction	Black ABS/polycarbonate blend; nylon fiber clip mounts to standard 35 mm DIN rail. 1 stainless steel right angle bracket and 1 PBT polyester bracket for mounting to flat surfaces also included with sensor.
Environmental Rating	IEC IP67; NEMA 6
Connections	2 m or 9 m PVC-jacketed 5-conductor cable, or 5-pin Euro-style quick-disconnect (QD) fitting. QD cordsets are ordered separately. See page 256. Fibers: Fiber clip (no tool required)
Operating Conditions	Temperature: -10° to +55° C Relative humidity: 90% at 50° C (non-condensing)
Application Notes	• Do not mount the fiber tip directly perpendicular to shiny surfaces; position it at approximately a 15° angle in relation to the sensing target • Minimize web or product "flutter" whenever possible to maximize sensing reliability
Certifications	CE
Hookup Diagrams	DC08 (p. 789)

Cordsets

Euro QD		
See page 727		
	Threaded 5-Pin	
Length	Straight	Right-Angle
1.83 m	MQDC1-506	MQDC1-506RA
4.57 m	MQDC1-515	MQDC1-515RA
9.14 m	MQDC1-530	MQDC1-530RA



Additional cordset information available. See page 721.

Brackets

R55F		
pg. 666	pg. 713	pg. 713
DIN-35...	SMBR55F01	SMBR55FRA

Additional bracket information available. See page 656.

Plastic Fiber Optics Specifications

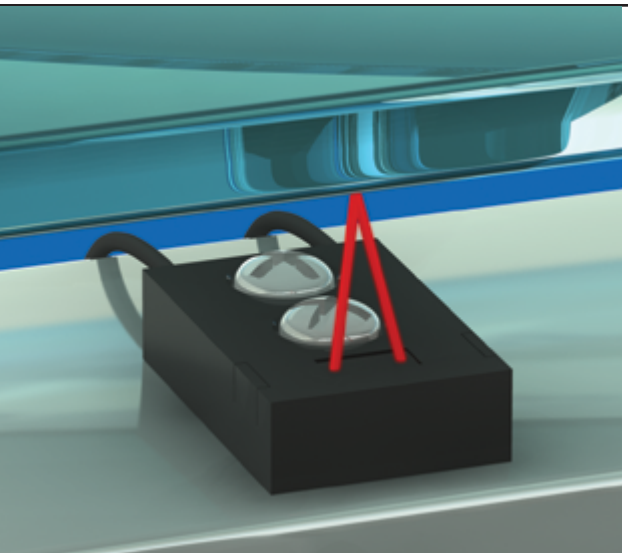
Construction	**Optical Fiber:** Acrylic (PMMA) monofilament, except as noted **Protective Jacket:** Black polyethylene, except as noted **Threaded End Tips and Hardware:** Nickel-plated brass, except as noted **Probe End Tips:** Annealed (bendable) 304 stainless steel **Angled End tips:** Hardened 304 stainless steel **Ferrule End Tips:** 303 stainless steel
Sensing Range	Refer to the specific fiber optic/sensor combination
Implied Dimensional Tolerance	**All dimensions are in millimeters:** x = ±2.5 mm, x.x = ±0.25 mm and x.xx = ±0.12 mm, unless specified. "L" = ±40 mm per meter
Minimum Bend Radius	8 mm for 0.25 mm diameter fibers 12 mm for 0.5 mm diameter fibers (except DURA-BEND™) 25 mm for 1.0 mm diameter fibers (except DURA-BEND™) 38 mm for 1.5 mm diameter fibers
Repeat Bending/Flexing	Life expectancy of plastic fiber optic cable is in excess of one million cycles at bend radii of no less than the minimum and a bend of 90° or less. Avoid stress at the point where the cable enters the sensor ("control end") and at the sensing end tip. Coiled plastic fiber optic assemblies are recommended for any application requiring reciprocating fiber motion.
Chemical Resistance	The acrylic core of the monofilament optical fiber will be damaged by contact with acids, strong bases (alkalis) and solvents. The polyethylene jacket will protect the fiber from most chemical environments. However, materials may migrate through the jacket with long term exposure. Samples of fiber optic material are available from Banner for testing and evaluation.
Temperature Extremes	Temperatures below -30° C will cause embrittlement of the plastic materials but will not cause transmission loss. Temperatures above +70° C will cause both transmission loss and fiber shrinkage.
Operating Temperature	-30° to +70° C, unless otherwise specified

Fiber Core Diameter Comparison

		N/A
PIT16U	PBT16U	
PIT26U	PBT26U	PBCT26U
PIT46U	PBT46U	PBCT46U
		N/A
PIT66U	PBT66U	

⚠ Application Notes and Warnings ⚠

1. Plastic fiber assemblies with "U" in the suffix of the model numbers have unterminated control ends (the end that is coupled to the photoelectric sensor). The customer can cut these fiber optic assemblies to the required length using the supplied cutter. Use only the supplied cutter to ensure optimal light coupling efficiency.
2. Terminated plastic fiber assemblies are optically ground and polished and cannot be shortened, spliced or otherwise modified.
3. Do not subject the plastic fibers to sharp bends, pinching, high tensile loads or high levels of radiation.
4. When ordering fiber lengths in excess of 2 m, take into account light signal attenuation due to the additional length.
5. Due to their light transmission properties, plastic fiber optics are recommended for use only with visible light fiber optic sensors.
6. Use caution when applying fiber optics in hazardous locations. Although fiber optic assemblies are, by themselves, intrinsically safe, the sensor and associated electronics must be LOCATED IN A SAFE ENVIRONMENT. Alternatively, fiber optics may be used with NAMUR sensor model Q45AD9FP (page 211). Fiber optics do not necessarily provide a hermetic seal between a hazardous environment and the safe environment.

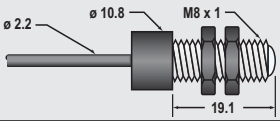
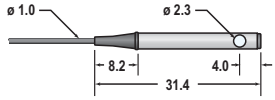
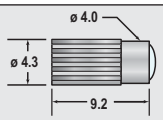
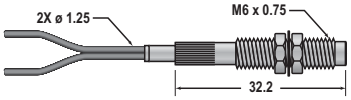
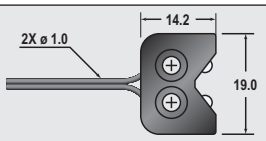
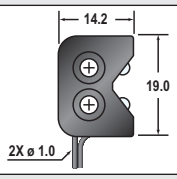
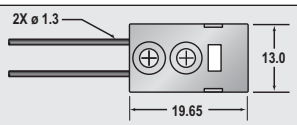
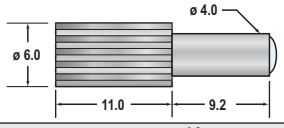
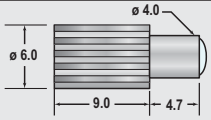
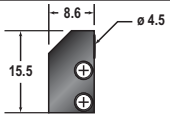


Focused & Extended Range Fibers

Lensed fiber models work well in confined areas, providing increased performance and reliability. They are also ideal for longer range applications, such as sensing in an intrinsically safe area, or applications requiring a focused beam for small features or objects.

- Range extension
- Fixed or adjustable lengths
- Small part counting and intrinsically safe area applications
- Longer range with opposed mode and shorter range with convergent mode
- Fiber and lens models available

ACCESSORIES PAGE 275

Fiber Mode	End Tip	Features	Typical Range (mm)		Model
OPPOSED		• 1.0 mm core diameter • 25 mm bend radius • Ultra-long range	DF-G1 D10D D10B D10A	4000 4000 4000 4000	PIL46U
		• 0.5 mm core diameter • 12 mm bend radius • Low beam divergence angle of ± 2° • Ideal for wafer mapping	DF-G1 D10D D10B D10A	2090 1500 860 800	PLIS-1
		• 1.0 mm core diameter • 25 mm bend radius • Range-extending lens • M2.5 thread	DF-G1 D10D D10B D10A	4000 4000 4000 4000	L2 w/PIT46U
DIFFUSE		• Anodized Aluminium tip • Beam spot ø 0.5-3.2 mm • Glass lens	DF-G1 D10D D10B D10A	32 32 32 32	PLI-A10
		• 0.5 mm core diameter • 12 mm bend radius • Straight exit • DURA-BEND fiber	DF-G1 D10D D10B D10A	Straight side exit with lenses; 3 mm focal distance	P22-C1
		• 0.5 mm core diameter • 12 mm bend radius • Side exit • DURA-BEND fiber	DF-G1 D10D D10B D10A	Straight side exit with lenses; 3 mm focal distance	P12-C1
		• 0.5 mm core diameter • 25 mm bend radius • Flat mount	DF-G1 D10D D10B D10A	Flat mount 6 mm focal distance, lenses convergent optics	P32-C6
		• Anodized Aluminium • Beam spot ø 0.25 mm @ 6 mm • Fixed focus	DF-G1 D10D D10B D10A	6 6 6 6	L4C6 w/PBCT26U
		• Anodized Aluminium • Beam spot ø 4 mm @ 20 mm • Fixed focus	DF-G1 D10D D10B D10A	20 20 20 20	L4C20 w/PBCT26U
		• Anodized Aluminium • Beam spot ø 0.5 - 3.2 mm • Adjustable focus	DF-G1 D10D D10B D10A	32 32 32 32	LZ3C8 w/PBTCT26UM3

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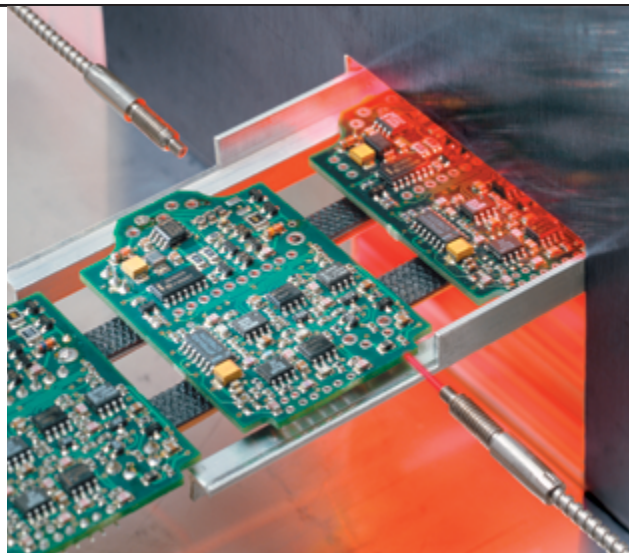
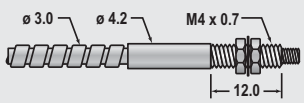
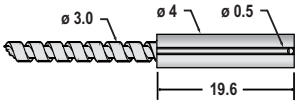
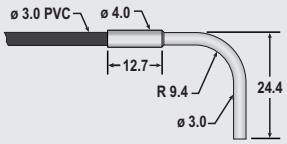
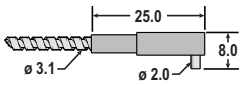
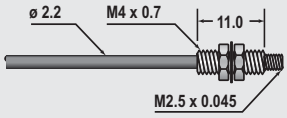
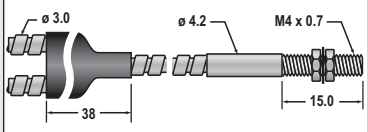
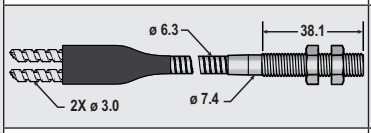
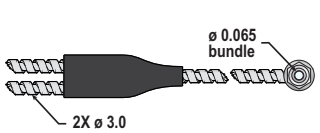
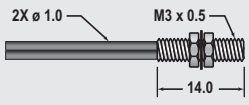
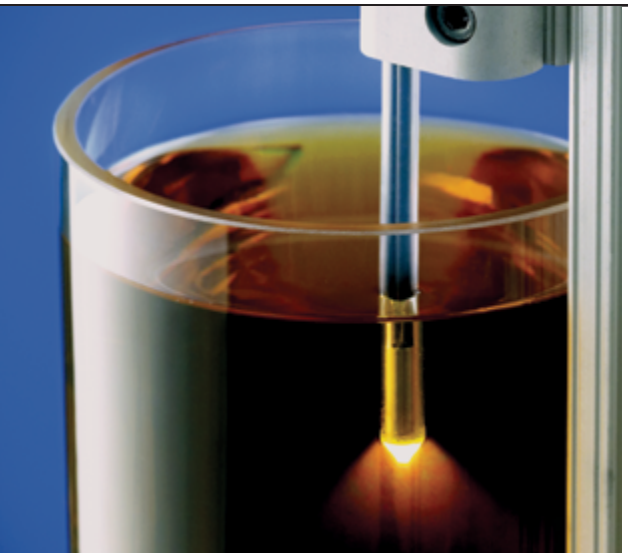
High Temp Fibers

High temp fiber optics are used in situations where the temperature is above a certain limit for most plastic fibers. These are usually used in thermal process applications and Banner offers the widest selection of plastic and glass fibers for high temperature situations.

- For high temp applications above 100° C
- Thermal process applications
- For sensing near manufacturing ovens
- Manufacturing of solar panels, colored glass and ceramics
- Widest selection of plastic and glass fibers for high temp applications



Fiber Mode	End Tip	Features	Typical Range (mm)	Model
OPPOSED		• 1.27 mm core diameter • 19 mm bend radius • Miniature thread • End tip withstands 315° C	DF-G1 774 D10D 1767 D10B 400 D10A 325	IMT.756.6S-HT
		• Smooth ferrule • Side exit • Stainless steel • 480° C	DF-G1 170 D10D 305 D10B 72 D10A 53	IA.31.7ST5ETA
		• Smooth ferrule • 90° angle • Stainless steel • 480° C	DF-G1 810 D10D 1200 D10B 430 D10A 312	IA.82.5PT5
		• Smooth ferrule • Side exit • Stainless steel • 480° C	DF-G1 810 D10D 1200 D10B 410 D10A 300	IA.83.3ST5ETA
		• 1.0 mm core diameter • 25 mm bend radius • Thread; withstands 105° C	DF-G1 600 D10D 850 D10B 270 D10A 210	PIT46UHT1
DIFFUSE		• 1.5 mm core diameter • 19 mm bend radius • Miniature thread • End tip withstands 315° C	DF-G1 50 D10D 67 D10B 19 D10A 15	BMT16.6S-HT
		• 1.5 mm core diameter • Threaded • Stainless steel • 480° C	DF-G1 240 D10D NA D10B NA D10A NA	BT13.5ST5
		• 1.7 mm core diameter • 12 mm bend radius • Thread right angle • Stainless steel • 480° C	DF-G1 270 D10D NA D10B NA D10A NA	BAT16.6ST5MTA
		• Thread; withstands 105° C	DF-G1 52 D10D 60 D10B 22 D10A 18	PBT26UHT2



Specialty Fibers

Specialty and custom fibers are designed for specific sensing applications. Many of the standard fibers can be customized and ready for use in days, not weeks. Banner excels in customization and will work with you to find the right solution.

- Custom design
- Chemical resistance
- Extreme environments
- Liquid level detection
- Customize bifurcations, material, lengths and other fiber features

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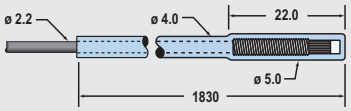
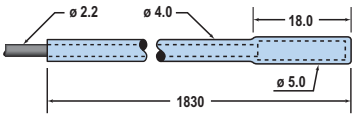
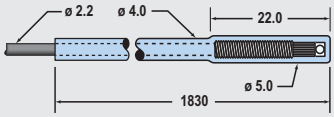
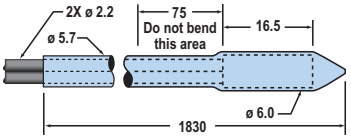
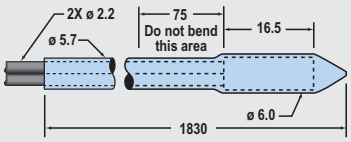
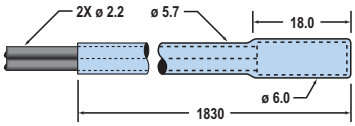
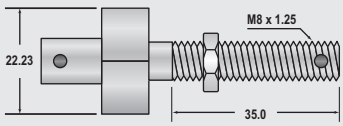
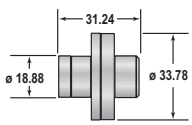
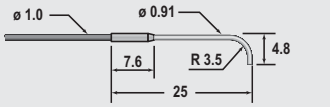
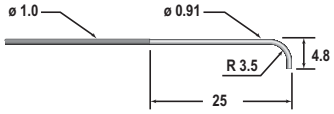
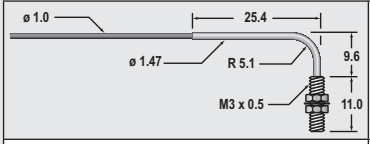
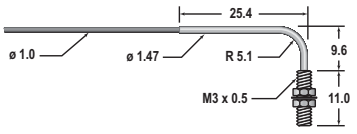
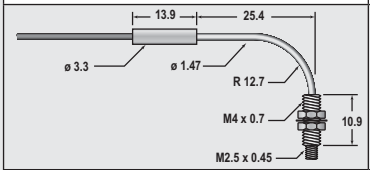
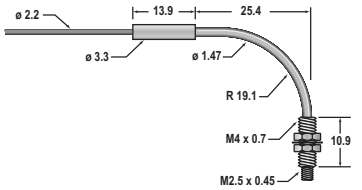
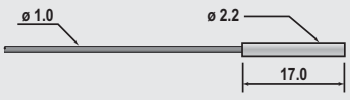
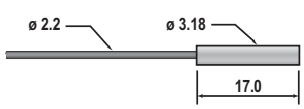
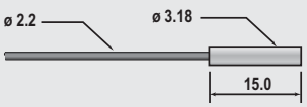
Fiber Mode	End Tip	Features	Typical Range (mm)		Model
OPPOSED		• 1.0 mm core diameter • 25 mm bend radius • Fluoropolymer encapsulated; lens	DF-G1 D10D D10B D10A	1900 2700 2000 1600	PIE46UT
		• 1.5 mm core diameter • 38 mm bend radius • Fluoropolymer encapsulated; lens	DF-G1 D10D D10B D10A	950 1400 440 300	PIE66UTMNL
		• 1.0 mm core diameter • 25 mm bend radius • Fluoropolymer encapsulated; side-view prism	DF-G1 D10D D10B D10A	400 575 300 280	PIES46UT
DIFFUSE		• 1.0 mm core diameter • 25 mm bend radius • Fluoropolymer encapsulated • Sensor switches when tip of fiber is immersed in liquid	DF-G1 D10D D10B D10A	N/A	PBE46UTMLLP
		• Fluoropolymer encapsulated • Sensor switches when tip of fiber is immersed in liquid • End tip withstands 105° C	DF-G1 D10D D10B D10A	N/A	PBE46UTMLLPHT1
		• 1.0 mm core diameter • 25 mm bend radius • Fluoropolymer encapsulated; tip	DF-G1 D10D D10B D10A	220 360 75 12	PBE46UTMNL
		• Stainless steel • Vacuum feed through	DF-G1 D10D D10B D10A	N/A Varies by fiber	VFT-M8MVS
		• Stainless steel • Vacuum feed through • For use with PIL45U or LO8FP	DF-G1 D10D D10B D10A	N/A Varies by fiber	VFT-1.3MRWM8

Standard Fibers

Standard fiber optics come in a variety of materials with standard fiber tips in various sizes. With the breadth of the product line, if a standard fiber does not meet your application requirements, modifications can be made to give you a customized solution.

- Plastic individual fibers ideal for use in small, confined areas
- Available in side view/right angles
- Available in bifurcated models
- Various tip and fiber sizes depending on application
- Widest selection of plastic fibers

Fiber Mode	End Tip	Features	Typical Range (mm)		Model
OPPOSED		• 0.25 mm core diameter • 8 mm bend radius • 90° angle	DF-G1 D10D D10B D10A	28 40 18 15	PIA16U
		• 0.5 mm core diameter • 12 mm bend radius • 90° angle	DF-G1 D10D D10B D10A	120 180 70 50	PIA26U
		• 0.25 mm core diameter • 8 mm bend radius • 90° angle • Thread	DF-G1 D10D D10B D10A	60 90 18 12	PIAT16U
		• 0.5 mm core diameter • 12 mm bend radius • Thread • 90° angle	DF-G1 D10D D10B D10A	200 280 100 50	PIAT26U
		• 1.0 mm core diameter • 25 mm bend radius • 90° angle • Thread	DF-G1 D10D D10B D10A	840 1200 320 275	PIAT46U
		• 1.5 mm core diameter • 38 mm bend radius • 90° angle • Thread • Long range	DF-G1 D10D D10B D10A	1280 2400 410 350	PIAT66U
		• 0.5 mm core diameter • 12 mm bend radius • Smooth ferrule	DF-G1 D10D D10B D10A	220 400 95 75	PIF26U
		• 1.0 mm core diameter • 25 mm bend radius • Smooth ferrule	DF-G1 D10D D10B D10A	820 1200 320 300	PIF46U
		• 1.5 mm core diameter • 38 mm bend radius • Smooth ferrule • Long range	DF-G1 D10D D10B D10A	1320 2400 600 525	PIF66U

More on next page